Novel System for Detection and Analysis of Low-Intensity X-Ray Flux Associated with Detonation of Conventional Ordnance and its Tactical Application

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Introduction

As of the 1960s, the exclusive application for space-based X-Ray detection was the detection of adversary nuclear testing. The ability to detect the X-Ray double-flash associated with nuclear detonations was, at one time, a cutting-edge ability which was eventually simplified to the point of becoming simply another add-on to other satellite systems (DDSP and subsequently, SBIRS.)

The ability to intercept and analyze X-Ray signatures has applications beyond the detection of nuclear events, opening up the possibility of a new class of orbital platform tasked with facilitating the detection, triangulation, and characterization of far-fainter X-Ray signatures.

Abstract

Modern X-Ray detection equipment is sufficiently advanced that it is possible to not only detect, but triangulate and characterize ultra-faint X-Ray signatures associated with the shearing of the metallic skin of explosive ordnance of various types, ranging from smart bombs to cruise missiles to explosions as small as that of a hand grenade.

Unlike the analysis of radioactive fallout to identify the ratios of radioactive isotopes with respect to one another and its potential use to determine the provenance of a weapon, this system would rely instead on differences in X-Ray output that stem from differences in composition and thickness of the shell itself and not so much from the type of explosive used. While slight differences in the volatility of specific explosive compounds do exist, much of the world uses one of only a few common explosive formulations. Beyond this, the differences between these formulations, although staggering in a chemical analysis, are almost meaningless in terms of this type of X-Ray analysis.

A detection system built along these lines would be able to estimate with a fair degree of accuracy event location and time, shell composition, shell thickness, and explosive magnitude sc. the yield in TNT equivalency. The combination of these factors would form the basis of an automated estimate of the nation of origin of the conventional munition employed as well as the type of round, be it man-portable i.e. a grenade, be it an artillery shell, or be it a guided bomb or missile.

This would not only enable the immediate identification of undisclosed arms sales (perhaps even during the act of testing these munitions) between nations in

support of intelligence gathering, but would, further, provide an additional, rich layer of tactical data never before enjoyed by any entity.

For instance, if the X-Ray signature of hand-grenades may be detected from space, this information could be used to enable a decision to use airborne assets to destroy a building in the process of being cleared by an adversary's military, given that it is a safe assumption that enemy forces are within that building at such a moment.

To cite another example, if a signature associated with a sub-launched (conventional) cruise missile is detected, this information may be used to enable naval assets to begin seeking the submarine that launched the missile. It may even be possible to estimate the point of origin provided that the missile is not programmed to follow a circuitous path, given that the X-Ray emission will "streak" in the direction of travel over the brief period of time it takes for the skin of the missile to tear apart.

Knowing whether an explosion was caused by sea or air-based attack may provide clues as to whether an area should be reinforced or evacuated i.e. one mode of attack may portend additional waves of attack, whereas another may more strongly indicate a "one and done" attack.

The instantaneous nature of feedback from such a system could enable the creation of a preliminary BDA in cases where friendly assets have been attacked, even in circumstances in which the area is too dangerous for a conventional BDA or in which one must wait hours for a reconnaissance satellite pass. For instance, if a friendly airbase is attacked, the magnitude and position of the detected explosions should provide invaluable information concerning the extent of the damage.

The system would also, naturally, be capable of providing instantaneous feedback in the event that a friendly missile failed to achieve its objective due to intercept or a failure to detonate upon impact.

Conclusion

A Space-Based X-Ray System (SBXRS) would likely prove highly useful for both intelligence gathering and for purposes of tactical awareness, rivaling the usefulness other constellations such as SBIRS and enhancing overall force tactical proficiency.